IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

BRUCE A. PHILLIPS et al.

Serial No.: 09/203,086

Filed: December 1, 1998

Group Art Unit: 2665

Examiner: S. Nguyen

For: System and Method for Increasing Distribution Distance of XDSL Type Signals

Attorney Docket No.: 1554/1556 (USW0464PUS)

APPEAL BRIEF

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This brief presents an appeal from the final rejection of claims 1-14 of the Office Action dated December 30, 2002. The application under consideration was filed on December 1, 1998.

I. REAL PARTY IN INTEREST

The real party in interest is Qwest Communications International Inc., a corporation organized and existing under the laws of the state of Delaware, and having a place of business at 1801 California Street, Suite 3800, Denver, Colorado 80202, as set forth in the assignment recorded in the U.S. Patent and Trademark Office on December 1, 1998, at Reel

9622/ Frame 0220; on November 26, 1999, at Reel 010421/Frame 0473; and on July 21, 2000, at Reel 10814/Frame 0339.

II. RELATED APPEALS AND INTERFERENCES

There are no appeals or interferences known to appellant(s), the appellant's(s') legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-14 are pending in this application. Claims 1-14 have been rejected and are the subject of this appeal.

IV. STATUS OF AMENDMENTS

An amendment after final rejection was filed on June 30, 2003, correcting an objection to claim 8 noted by the Examiner. It is not known whether or not this amendment has been accepted or denied entry. Claim 8 appears in the appended claims without this amendment.

V. SUMMARY OF THE INVENTION

With regard to Figures 1 and 2, Appellants' invention includes regenerator 32 for use in a digital subscriber line (XDSL) distribution system 10. Distribution system 10 includes central office 18, also known as an XDSL transmission unit (XTU_{co}), for transmitting video signals on a twisted pair copper cable 22 along with other telephony and digital data signals to at least one end user location 16 having XTO_{cust} 28.

Telephony signals are base band signals. Base band signals have a two-sided power spectral density centered around a frequency of zero. Put another way, base band signals have a frequency range similar to, or the same as, the frequency range of a transducer generating the signals. In the case of a telephone signal, the frequency range is a subset of the

range of the human voice. In contrast, XDSL signals are broadband signals. Broadband signals are created by modulating a carrier signal with information. The result is that the information frequency spectrum is shifted up in frequency to around the carrier frequency. An advantage of XDSL is that the broadband XDSL signal spectrum and the base band telephony spectrum do not overlap, allowing both to be transmitted over twisted cable 22 simultaneously. This is generally known as frequency division multiplexing.

Regenerator 32 includes receiver 34, 44; decoder 36, 46; encoder 40, 50; and line driver 42, 52. Receiver 34, 44 receives XDSL signals transmitted on the twisted pair copper cable 22 from central office 18 or end user 28, respectively. Decoder 36, 46 decodes the payload of a received XDSL signal into base data. Encoder 40, 50 packages and encodes the base data into a desired protocol format. Line driver 42, 52 retransmits the encoded signal onto twisted pair copper cable 22, 30 for distribution to an original destination.

As is well known in the art, a receiver demodulates a modulated signal. Thus, the result of receiver 34, 44 and decoder 36, 46 is to convert the broadband XDSL signal into base band, decoded data.

> Regenerator unit 32 includes a receiver 34 for receiving signals from XTU_{co} 18, a decoder 36 for analog-to-digital conversion and decoding of the payload of the received base digital data, and a buffer 38 for temporary base data. Receiver 34 includes a suitable timer for extracting the timing of the incoming signals when an ATM protocol is used.
>
> Application Specification, pg. 6, ll. 22-26.

Encoder 40, 50 and line driver 42, 52, repackage, encode, and remodulate the base band data to produce a new XDSL signal.

> An encoder 40 then reforms or repackages the data from buffer 38 into XDSL line signals, and a line driver retransmits the encoded signals onto the distribution line.
>
> Application Specification, pg. 6, ll. 27-28.

Thus, Appellants' invention demodulates, decodes, repackages, encodes and remodulates XDSL signals.

Regenerator 32 is located a predetermined distance along twisted pair copper cable 22, 30 such that the signal-to-noise (S/N) ratio of a transmitted XDSL signal reaches a threshold of minimum acceptable signal quality.

> In accordance with the present invention, in order to extend the otherwise limited distribution range of XDSL encoded signals, a regenerator unit 32 is located at predetermined distances on the distribution line. The ATM layer transported on the distribution line will be repackaged and retransmitted at the regenerator to insure the data payload is valid. The predetermined location of a regenerator unit is calculated based on the effective loss of signal as a result of such factors as wire gauge, temperature, and distance, such that the regenerator unit will be located at a distance corresponding to a point where the calculated S/N ratio reaches a threshold of minimum acceptable signal quality. In an exemplary embodiment, the S/N ratio threshold is 18.5.

Patent Application, pg. 6, ll. 12-21.

VI. ISSUES

The following prior art was cited by the Examiner in the final Office Action and is referenced in this Appeal Brief:

U.S. Patent No. 5,905,781 to McHale *et al.* (McHale);

U.S. Patent No. 4,766,606 to Bardutz *et al.* (Bardutz);

U.S. Patent No. 6,219,387 to Wu (Wu).

The only issue presented in this appeal, based on the Examiner's rejections in the final Office Action, is as follows:

Whether claims 1-14 are obvious in view of McHale, Bardutz and Wu.

VII. GROUPING OF CLAIMS

Claims 1-14 are grouped to stand or fall together.

VIII. ARGUMENT

Independent claims 1, 7 and 13 were rejected under 35 U.S.C. § 103(a) as being unpatentable over McHale in view of Bardutz and Wu.

Independent claim 1 provides a system for distributing digital subscriber line (XDSL) signals to end users over a telephone wiring plant. A central office receives video signals from a video source. The central office includes a first XDSL transmission unit for transmitting the received video signals on twisted pair copper cable along with other telephony and digital data signals and for receiving data signals from end users. At least one end user location has a second XDSL transmission unit for receiving video signals from twisted pair copper cable and for transmitting data signals to the central office. A regenerator is connected to twisted pair copper cable and located a predetermined distance from the central office. The regenerator includes a receiver for receiving XDSL signals transmitted on twisted pair copper cable from either the central office or the end user. A decoder decodes the payload of a received XDSL signal into base data. An encoder repackages and encodes the base data into a desired protocol format. A line driver retransmits the encoded signal onto the twisted pair copper cable for distribution to an original destination. The predetermined distance for the location of the regenerator corresponds to a point on the twisted pair cable where the signal-to-noise ratio of a transmitted XDSL signal reaches a threshold of minimum acceptable signal quality. Claims 2-6 depend from claim 1.

Independent claim 7 provides a method for distributing digital subscriber line (XDSL) signals to end users over a telephone wiring plant. Video signals from a video source are received at a central office. The received video signals are transmitted on a twisted pair copper cable along with other telephony and digital data signals as an XDSL type signal to a terminal located at an end user site. Data signals are received on the twisted pair copper cable at the central office from an end user terminal. A signal regenerator unit is coupled to the twisted pair copper cable at a distance from the central office corresponding to a point on the twisted pair cable where the signal-to-noise ratio of a transmitted XDSL signal reaches a threshold of minimum acceptable signal quality. Transmitted XDSL signals are received at the

regenerator and decoded into base data. The base data is repackaged and encoded into an XDSL signal having a desired protocol format. The XDSL signal is retransmitted to the end user terminal. Claims 8-12 depend from claim 7.

Independent claim 13 provides a regenerator for use in a digital subscriber line (XDSL) signal type signal distribution system. The distribution system includes a central office for transmitting video signals on a twisted pair copper cable along with other telephony and digital data signals to at least one end user location. The regenerator includes a receiver for receiving XDSL signals transmitted on the twisted pair copper cable from either the central office or the end user. A decoder decodes the payload of a received XDSL signal into base data. An encoder repackages and encodes the base data into a desired protocol format. A line driver for retransmits the encoded signal onto the twisted pair copper cable for distribution to an original destination. A predetermined distance for the location of the regenerator corresponds to a point on the twisted pair cable where the signal-to-noise ratio of a transmitted XDSL signal reaches a threshold of minimum acceptable signal quality. Claim 14 depends from claim 13.

According to M.P.E.P. § 2142, three criteria must be met for the Examiner to establish a *prima facie* case of obviousness. First, there must be some suggestion or motivation, either in McHale, Bardutz, Wu or in knowledge generally available to one of ordinary skill in the art, to modify McHale. Second, there must be a reasonable expectation that this modification will succeed. Finally, either McHale, Bardutz or Wu must teach or suggest all claim limitations.

No combination of McHale, Bardutz and Wu teach each of Appellants' claim limitations. In addition, there is no reasonable expectation that the Examiner's combination of Bardutz into McHale or Wu will succeed.

1. No Combination of McHale, Bardutz and/or Wu Disclose the Elements of Appellants' Regenerator

The Examiner suggests that McHale teaches the basic structure of a central office with XDSL capabilities communicating with end users. The Examiner admits that "McHale does not disclose a regenerator which disposes between the central office and the end user." (Pp. 3-4.) The Examiner appears to propose either Wu or Bardutz as supplying Appellants' regenerator.

The Examiner first attempts to find a suggestion for Appellants' regenerator in Wu, providing the following argument:

> In the same field of endeavor, Wu discloses a repeater which disposes between the central office and the end user for boosting the signal if the distance between the central office and end user is greater than a predetermined distance (See Fig 1 and col. 4, lines 25-60) ...

Wu's Figure 1 is a block diagram showing an Internet service provider (ISP), central office (CO) and user environment (H). No regenerator or repeater of any kind is shown. The only mention of anything remotely similar to Appellants' regenerator in the passage cited by the Examiner is at column 4, lines 55-60, as follows (emphasis added):

> Alternatively, if user environment H is more than this specified distance [18,000 feet] from central office CO, one or more signal repeaters (not shown) may be included within twisted pair wire facility TWP to *boost the signals* along their respective paths, particularly from central office CO to user environment H.

Appellants note that the cited passage does not teach how to make *any* repeater, let alone Appellants' regenerator. More importantly, Appellants' regenerator does not "boost the signals" as suggested by Wu. Appellants' regenerator receives a broadband XDSL signal, decodes the signal to base band data, repackages and encodes the base band data into a desired protocol format, and retransmits the encoded signal by modulation back to broadband XDSL. In fact, the suggestion to "boost the signal" teaches away from Appellants' regenerator, which transmits a different XDSL signal than it receives.

The Examiner also asserts that Appellants' regenerator is disclosed by Bardutz. The Examiner's assertion regarding the disclosure in Bardutz is at page 4, reproduced as follows:

> Bardutz discloses (Col 2, lines 45 to col. 4, lines 14) a repeater "regenerator" (Fig 1, Ref Rep 1) which disposes between the central office (Fig 1, Ref office terminal), includes a receiver for receiving a signal (col. 2, lines 51, coupling means), a decoder (col. 2, lines 55-60, data recovery means) for decoding the payload of a received signal into a base data, a encoder (Col. 2, lines 60-65) for encoding and repacking the base data into a desired protocol format and a line driver (Col. 2, lines 52-53, the regenerated signals is recoupled to the line) for retransmitting the encoded signals to the end user wherein the repeat ·s disposed at a predetermined distance where the SNR of the ial is reached to a threshold of minimum acceptable signal lity (it is implicitly).

The Examiner does ..ot appear to understand the operation of Bardutz's repeater.

Bardutz discloses a signal repeater that is part of a system which "provides four voice channels over a single pair telephone line." (Col. 5, ll. 54-55.) The repeater is described in column 6, lines 3-6, as follows:

> The repeater of the present invention is used to regenerate digital pulses sent over the single pair telephone line which interconnects the central office and subscriber terminals.

Bardutz's repeater works on base band data and not modulated data such as XDSL signals. Further evidence is provided at column 7, lines 8-48.

> The central office terminal line card buffers and converts several samples of the voice frequency signals of each incoming central office line to PCM (pulse code modulated) signals, inserts the appropriate supervisory signaling bits, and then transmits them through the assigned channel in repetitive bursts at 768 kbits/second. The associated remote subscriber terminal also converts and buffers the voice frequency signal, together with its operational status, to PCM pulses, and then transmits them to the line card in an assigned time slot after the data from the line card is received. When the line card receives the

incoming PCM pulses, it converts them back to voice frequency signals and diverts them to the appropriate central office line. The operation outlined above is repeated in an endless loop.

All voice and signalling information is digitally multiplexed into a 768 kbit/second digital data stream, with full duplex operation achieved by time compression multiplexing (TCM). Packets of data are sent in each direction alternately (ping-pong technique), with the bit stream changing direction at a 667 cycle/second rate. The line bit format is modified duobinary; therefore, most of the energy is concentrated at a line frequency of 192 KHz.

The following table summarizes the system transmission characteristics.

Transmission scheme	Time compression multiplexing
Coding Format	Precoded modified duobinary
Bit Rate	768 Kb/s
Speech sampling rate	8 KHz
Companding law	u = 255
Voice code	8 bits per sample
Duty cycle	100%
Transmit pulse amplitude	±3 volts . +-.5%
Receive pulse amplitude	±150 mv minimum
Line impedance	100 ohms balanced at 192 KHz

Bardutz discloses converting analog voice signals from four sources into pulse signals, compressing the pulse signals and interleaving, or time division multiplexing, these signals for transmission over a single line. In contrast, as is well known in the art, XDSL signals use frequency modulation to achieve frequency division multiplexing. Frequency modulation generates XDSL signals shifted in the frequency spectrum, allowing the XDSL signals and base band telephone voice signals to be transmitted *simultaneously* over the same line. Hence the need for a receiver in Appellants' system to demodulate or frequency shift the XDSL signals back to base band before these signals can be decoded to obtain the base data. Once this is understood, it becomes clear that Bardutz's repeater cannot function as Appellants' regenerator.

The Examiner states "Bardutz discloses (Col 2, lines 45 to col. 4, lines 14) a repeater "regenerator" (Fig 1, Ref Rep 1) which disposes between the central office (Fig 1, Ref office terminal), *includes a receiver for receiving a signal* (col. 2, lines 51, coupling means) . . ." (Emphasis added.) There is no indication that Bardutz's "coupling means" is Appellants' XDSL receiver. As illustrated in Figure 3a, "an electronic circuit schematic diagram of the line coupling sub-section of the repeater transmitter subsection," Bardutz's coupling means is a transformer, which will not work as an XDSL receiver *or as a receiver for any other type of frequency modulated signal.* In response to this argument, the Examiner indicated that McHale disclosed the use of a transformer in an XDSL system. This may be true, but that is not what Appellants argue. Appellants do not argue that a transformer cannot be used in an XDSL system, but rather that such a transformer is not an XDSL receiver. A transformer cannot frequency shift or demodulate an XDSL signal.

Appellants point out that the *Examiner's own construction* requires Bardutz to disclose an XDSL receiver. Thus, in arguing that no such receiver is taught or suggested by Bardutz, Appellants are not "attacking references individually where the rejections are based on combinations of references" as suggested by the Examiner.

The Examiner also asserts that Bardutz discloses "a encoder (Col. 2, lines 60-65) for encoding and repacking [*sic*] the base data into a desired protocol format." The section cited by the Examiner is reproduced as follows:

> The repeater comprises . . . data conversion means for re-encoding the regenerated signals for recoupling thereof onto the line; and, signal processing means for controlling the operation of the signal coupling means, the clock recovery means, the data recovery means and the data conversion means.

An embodiment of Appellants' repackaging is described on page 7, lines 16-27, as follows:

> Referring now to Figure 2, a flowchart illustrates the overall operation of the regeneration unit 32. As denoted at block 100, XDSL signals transmitted from either XTU_{co} 18 or XTU_{cust} are received by receivers 34 or 42. The received signal payload is subsequently decoded into a base data level at block 102, and temporarily stored in the appropriate buffer at block

104.   At block 106, a decision is made as to whether the destination of the signal requires ATM layer processing. If so, the payload base data is retrieved from the buffer and reframed or repackaged with the appropriate ATM framing including the necessary loop timing at block 108. If ATM layer processing required, the payload base data is retrieved from the buffer and packaged for direct retransmission at block 110.

As denoted at block 112, once the payload has been repackaged, the signal is encoded for transmission.

Repackaging, according to the preferred embodiment, is ATM framing with appropriate loop timing. This is a separate and distinct operation from encoding. While Bardutz may suggest some form of encoding, Bardutz neither teaches nor suggests any kind of repackaging, or packaging for that matter. This is probably because there is no need to perform such repackaging in Bardutz's simple time division multiplexed system.

Once again, the *Examiner's own construction* requires Bardutz to disclose such repackaging. In arguing that Bardutz fails to do so, Appellants are not "attacking references individually where the rejections are based on combinations of references" as asserted by the Examiner.

The Examiner has failed to find any teaching or suggestion, in any combination of McHale, Bardutz and Wu, for each of Appellants' regenerator limitations in claims 1, 7 and 13.

2.   **No Combination of McHale, Bardutz and/or Wu Discloses Locating Appellants' Regenerator Where the S/N Ratio of a Transmitted XDSL Signal Reaches a Threshold of Minimum Acceptable Signal Quality**

Claim 1 provides "... tor connected to the twisted pair copper cable and located a predetermined distance fro.   itral office ... wherein the predetermined distance for the location of the regenerator corresponds to a point on the twisted pair cable where the signal-to-noise ratio of a transmitted XDSL signal reaches a threshold of minimum acceptable signal quality." Claim 7 provides "coupling a signal regenerator unit to the twisted pair copper cable at a distance from the central office corresponding to a point on the twisted pair

cable where the signal-to-noise ratio of a transmitted XDSL signal reaches a threshold of minimum acceptable signal quality." Claim 13 provides "a predetermined distance for the location of the regenerator corresponds to a point on the twisted pair cable where the signal-to-noise ratio of a transmitted XDSL signal reaches a threshold of minimum acceptable signal quality." The Examiner asserts that Wu and Bardutz disclose Appellants' regenerator location.

In response to Appellants' assertion that Wu neither teaches nor suggests locating a regenerator at a point on the twisted pair cable where the signal-to-noise ratio of a transmitted XDSL signal reaches a threshold of minimum acceptable signal quality, the Examiner stated the following at page 6:

> [T]he applicant states that Wu does not disclose a repeater being located at a point on the twisted pair cable where the signal to noise ratio ... nsmitted XDSL signal reaches a threshold of minimu... able signal quality. In reply, it is implicitly disclosed i s reference because the distance between the central offi. end user site has a limit such [sic] 18000 feet wherein the nal will be degraded, such as Signal to Noise ratio reaches threshold of minimum acceptable signal quality, if the signal pass the limitation. Therefore, if a service provider would like to transmit a XDSL signal to a subscriber having a distance above 18000 feet, the service provider must place a repeater between the central office and the end user site.

The Examiner appears to be saying that, since Wu discloses an approximate limit for transmitting ADSL or MDSL signals, Wu *inherently* discloses Appellants' regenerator location. Since there are many ways in which Wu's repeater could be located, there is no inherent teaching of Appellants' regenerator location. At best, Wu implies locating a signal boosting repeater at a distance of 18,000 feet from the central office, a value not based in any manner on a signal-to-noise threshold but on the absolute failure of the system to operate at a greater distance.

The Examiner also attempts to find Applicants' regenerator location in Bardutz, stating "the repeater is disposed at a predetermined distance where the SNR of the signal is reached to a threshold of minimum acceptable signal quality (it is implicitly)." There is no

such implicit teaching in Bardutz. Bardutz describes where repeaters may be located in column 6, lines 8-18, as follows:

> The repeater housings are normally mounted on telephone poles or pedestals co-located with an existing loading coil location along the cable route.
> * * * *
> Repeaters are normally required every 32 to 37 db. of line loss, which translates into approximately 3.5 miles if 19 gauge wire is used, 3.0 miles if 22 gauge is used and 2.5 miles if 24 gauge wire is used.

Bardutz discloses locating repeaters based on at least one of two conditions: where loading coils are located on telephone poles or pedestals and where a certain amount of signal loss is obtained. Neither of these teach or suggest Appellants' locating regenerators based on a signal-to-noise threshold.

Thus, the Examiner has failed to find any teaching or suggestion, in any combination of McHale, Wu or Bardutz, for Appellants' location of a regenerator corresponding to a point on twisted pair cable supplying the regenerator where the signal-to-noise ratio of a transmitted XDSL signal reaches a threshold of minimum acceptable signal quality.

3.   **The Examiner's Combination of McHale, Wu and Bardutz Will Not Succeed**

There is no reason to believe that the Examiner's proposed combination of McHale, Wu and Bardutz will succeed. The Examiner cites McHale as generally disclosing an XDSL network. The Examiner can point to no teaching or suggestion in McHale for any regenerator, repeater or anything of the kind. The Examiner provides Wu for suggesting a signal-boosting repeater located somewhere between a central office and a user environment. The Examiner points to no teaching or suggestion in Wu for any device, system or method for accomplishing this signal boosting. Finally, the Examiner cites Bardutz's repeater as disclosing Appellants' regenerator.
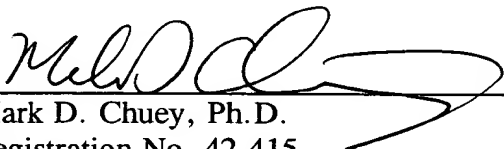
The only logical interpretation of the Examiner's construction is that the Examiner intends to insert Bardutz's repeater into McHale's XDSL system. However, since Bardutz's repeater operates on base band, time division multiplexed signals, and not modulated XDSL signals, the resulting combination will not produce Appellants' invention. Further, this combination will render McHale's system totally inoperative, since Bardutz's repeater will block any XDSL signal sent to it.

In conclusion, the Examiner has failed to establish a *prima facie* case that claims 1, 7 and 13 are obvious in view of any combination of McHale, Wu and Bardutz. Appellants therefore respectfully request that this application be passed to issuance.

The fee of $320 as applicable under the provisions of 37 C.F.R. § 1.17(c) is enclosed. Please charge any additional fee or credit any overpayment in connection with this filing to our Deposit Account No. 02-3978. A duplicate of this notice is enclosed for this purpose.

Respectfully submitted,

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Enclosure - Appendix

IX. APPENDIX - CLAIMS ON APPEAL

1   1.   A system for distributing digital subscriber line (XDSL) signals

2   to end users over a telephone wiring plant comprising:

3   a central office for receiving video signals from a video source, the

4   central office including a first XDSL transmission unit for transmitting the received

5   video signals on a twisted pair copper cable along with other telephony and digital

6   data signals, and receiving data signals from end users;

7   at least one end user location having a second XDSL transmission unit

8   for receiving video signals from the twisted pair copper cable and transmitting data

9   signals to the central office; and

10   a regenerator connected to the twisted pair copper cable and located

11   a predetermined distance from the central office, the regenerator comprising:

12   a receiver for receiving XDSL signals transmitted on the

13   twisted pair copper cable from either the central office or the end user;

14   a decoder for decoding the payload of a received XDSL signal

15   into base data;

16   an encoder for repackaging and encoding the base data into a

17   desired protocol format; and

18   a line driver for retransmitting the encoded signal onto the

19   twisted pair copper cable for distribution to an original destination, wherein

20   the predetermined distance for the location of the regenerator corresponds to

21   a point on the twisted pair cable where the signal-to-noise ratio of a

22   transmitted XDSL signal reaches a threshold of minimum acceptable signal

23   quality.

1   2.   The system of claim 1 wherein the central office transmits

2   XDSL signal using an asynchronous transfer mode (ATM) protocol, and the

3   regenerator encoder is arranged to selectively repackage the base data into either the

4   ATM protocol format or a direct transmission protocol format depending on the

5   protocol requirements of the original destination.

1   3.   The system of claim 1 wherein the XDSL signals comprise

2   very-high-rate digital subscriber line (VDSL) type signals.

1   4.   The system of claim 1 wherein the XDSL signals comprise

2   asynchronous digital subscriber line (ADSL) type signals.

1   5.   The system of claim 1 wherein the line driver comprises a

2   variable rate line driver.

1   6.   The system of claim 1 wherein the line driver comprises a fixed

2   rate line driver.

1   7.   A method for distributing digital subscriber line (XDSL)

2   signals to end users over a telephone wiring plant comprising:

3   receiving video signals at a central office from a video source;

4   transmitting the received video signals on a twisted pair copper cable

5   along with other telephony and digital data signals as an XDSL type signal to a

6   terminal located at an end user site, and receiving data signals on the twisted pair

7   copper cable at the central office from an end user terminal;

8   coupling a signal regenerator unit to the twisted pair copper cable at

9   a distance from the central office corresponding to a point on the twisted pair cable

10   where the signal-to-noise ratio of a transmitted XDSL signal reaches a threshold of

11   minimum acceptable signal quality;

12   receiving transmitted XDSL signals at the regenerator, and decoding

13   the received signals into base data;

14   repackaging and encoding the base data into an XDSL signal having

15   a desired protocol format; and

16   retransmitting the XDSL signal to the end user terminal.

1   8.   The method of claim 7 further comprising transmitting XDSL

2   signals from the central office transmits using an asynchronous transfer mode (ATM)

3   protocol, and selectively repackaging the base data into either the ATM protocol

1   format or a direct transmission protocol format depending on the protocol

2   requirements of the destination original terminal.

1   9.   The method of claim 7 further comprising transmitting the

2   received video signals as very-high-rate digital subscriber line (VDSL) type signals.

1   10.   The method of claim 7 further comprising transmitting the

2   received video signals as asynchronous digital subscriber line (ADSL) type signals.

1   11.   The method of claim 7 further comprising retransmitting the

2   XDSL signals from the regenerator with a variable data rate.

1   12.   The method of claim 7 further comprising retransmitting the

2   XDSL signals from the regenerator with a fixed data rate.

1   13.   A regenerator for use in a digital subscriber line (XDSL) signal

2   type signal distribution system, the distribution system including a central office for

3   transmitting video signals on a twisted pair copper cable along with other telephony

4   and digital data signals to at least one end user location, the regenerator comprising:

5   a receiver for receiving XDSL signals transmitted on the twisted pair

6   copper cable from either the central office or the end user;

7   a decoder for decoding the payload of a received XDSL signal into

8   base data;

9   an encoder for repackaging and encoding the base data into a desired

10 protocol format; and

11   a line driver for retransmitting the encoded signal onto the twisted pair

12 copper cable for distribution to an original destination, wherein a predetermined

13 distance for the location of the regenerator corresponds to a point on the twisted pair

14 cable where the signal-to-noise ratio of a transmitted XDSL signal reaches a threshold

15 of minimum acceptable signal quality.

16   14.   The regenerator of claim 13 wherein the receiver, decoder and

17 encoder comprise a very-high-rate digital subscriber line (VDSL) type receiver,

18 decoder and encoder.